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Eco-bio-social determinants of Aedes infestation in Dhaka, Bangladesh

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Background: Globally, vector borne diseases are becoming a significant public health problem, with a number of 'old' diseases resurging in recent years alongside newly emerging infectious diseases. Among them, Dengue has become most prominent example. While dengue is regarded as one of the most alarming infectious diseases, its resurgence reflects the failure of traditional reductionistic disciplinary approach in understanding dengue disease transmission process as well as in eliminating and controlling dengue vectors (i.e., *Aedesaegypti* and *Aedesalbopictus*). My research is based on the notion that the understanding of the dengue transmission requires the development of a holistic epistemology that can assess the eco-bio-social determinants and their interactions with human action and vice versa. The proposed study has four components: i) determination of dengue virus prevalence, ii)determination of vector density and its correlation with dengue prevalence; iii) effects of local-level social-ecological and human behavioural factors on vector density; and iv) enhancement oflocal community capacity for public participation in health intervention and development policyforums.

Methods: The proposed research has adopted a transdisciplinary approach as the basis forunderstanding dengue transmission in Bangladesh and for identifying community-centered interventions.In order to attain the objectives of the research, a total of 842 households from 12 urban wards were surveyed with a specific survey instrument. Vector distribution was monitored and vector density has been calculated by the commonly used larvalindices and the human-hour catch and per room collection of adult vector population. For in-depth understanding and identification of potential interventions, Focus Group Discussions were held in three selected wards of the City of Dhaka. These were supplemented by semi-structured interview of 30 stakeholders representatives; responses from 300 ward/community members; 12 policy- and/or decision makers (national and local institutions), and Mental Map construction of 24 ward representatives (supplemented by 300 ward members).

Results: Overall, the findings have revealed that vast majority of the community members are well aware of Aedes infestation, however, very few have taken specific measures to control them in their household and in the neighbourhood.

Conclusion: It is suggested that more community ownership will be required to make Aedes control a success.

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Developing an economic-epidemiological model system to allow economic evaluation of pandemic influenza preparedness policies

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Background: Recent estimates suggest that emergence of an influenza strain similar to the 1918 pandemic may cause up to 62 million deaths globally, but importantly 96% of these are predicted to occur in low income countries. Zoonotic H5N1 avian influenza continues to infect and kill humans, including recent deaths in Cambodia and Indonesia. Although the risk from pandemic influenza is real, poor countries present a range of opportunities for inexpensive public health gains, which pandemic preparedness policies must be compared against when considering investment.

While there have been economic evaluations of pandemic influenza preparedness policies in high income countries there are none which look specifically at low income countries. These studies tend to focus of influenza specific interventions, ignoring investment in general hospital resources to strengthen surge capacity, do not explore intra-country geographic variation and neglect aspects of uncertainty in the timing and virulence of disease.

Methods: Through reviewing state-of-the-art methods in health economic and infectious disease transmission modelling we identify approaches to facilitate economic evaluation of pandemic influenza policy. Models were developed using the statistical package R and apply sets of differential equations to describe populations and processes within the model structure.

Results: The developed model system contains four components:

i) An influenza transmission model
ii) A health system resources model
iii) A pandemic cost of illness and economic impact model
iv) A cost of pandemic preparedness policy option model

The transmission model describes Susceptible (S), Exposed (E), Infectious (I) and Recovered/Dead (R) populations separately per province of Cambodia. The populations are heterogeneous, with separate mixing patterns for different age groups. Health impact is estimated through the interaction with the transmission (i) and resource (ii) models. For each pandemic scenario the net cost is calculated from the pandemic (iii) and policy (iv) cost models.

Using 'Monte Carlo' simulation we vary the virulence of the pandemic strain and the timing of the pandemic event allowing probabilistic analysis of policies across a high number of possible future scenarios.

Conclusion: We have developed a sophisticated model system which incorporates variability in population, health system and pandemic characteristics.

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